alone. And so it seems to me that a report on such joint work is peculiarly fitting before this academy, which I assume, if it stands for anything, stands for cooperation and mutual help among men of science.

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MR. EDISON'S SERVICE FOR SCIENCE[1]

ALL the world is indebted to Mr. Edison, but the portion of it that is under special obligation is the educational world, particularly the schools of technology. It is not merely that he has helped them by criticism and constructive suggestion; it is not merely that by financial assistance he has enabled them to carry on scientific investigations in fields that he has cultivated with such remarkable success; but it is mainly because he has himself been for a generation an educational institution of the first rank. As much as any other school he has had a profound influence throughout the country in arousing in the minds of young men some sense of the limitless possibilities of science when devoted to the service of man and some appreciation of the conditions under which great problems of industrial improvement must be attacked if lasting victories are to be won. It has been a great thing for America to have such a central figure in this age of applied science—a man with such a hold on the popular imagination as to force men to watch what he is doing, for in studying Edison there can not fail to be revealed something of the underlying forces that mould the world of modern industry.

I have said that Mr. Edison is an institute of technology or a school of applied science. Such an institution, if it be worth anything, stands preeminently for three things: for belief in science and in its powers of service, for understanding and appreciation of the method of science, and in the third place, for faith in the gospel of work.

Edison more than any one else in this country has taught men to see something of what science can do. It would, of course, be impossible on such an occasion as this to enumerate the accomplishments of a life so rich in great achievements. With such an embarrassment of riches, it is scarcely practicable even to single out a few of his great accomplishments. Many of you are familiar with what he did in the early days by way of improving the duplex and quadruplex systems of telegraphy, you know of his invention of the contact transmitter and his development of the loud-speaking telephone, of his marvelous invention of the phonograph (Edison being the first to make a record that would *reproduce* sound), you think of his wonderful work in 1878 and later years in developing the incandescent lamp, and you realize that he practically made the *whole* incandescent system, not only inventing the lamp, but turning his attention to all its adjuncts, improving the dynamos for such work and providing the necessary means for the distribution of power over large areas. You recognize that he laid the foundations for the design of central power stations and that his Pearl Street Station was a landmark in the history of science. His work in this field is truly phenomenal, the three-wire distribution, the system of feeders entering the network of mains at different points, the underground conductor system, the bus system in stations, the innumerable accessories of switches, fuses, meters, etc., that he provided are each achievements that would make the fame of any individual. You appreciate the remarkable character of his later work in developing the apparatus of moving pictures and you agree that what he has done still more recently in perfecting the alkaline storage cell is a splendid example of energy and persistence in attacking a difficult problem. Thinking of all these things, you can not fail to be impressed with two things—the enormous range of his activities and the wonderful simplicity of many of his devices. After all, simplicity of device is always the sign of the master, whether in science or in art. In studying Edison you have something of the same impression as in studying Newton

[1] Address at the Civic Forum, New York, May 6, 1915, on the occasion of the presentation of its medal for public service to Mr. Edison.

—you are surprised how easy are the steps. Some one asked Lord Kelvin why no one before Edison had invented so *simple* a thing as the feeder system. "The only reason I can think of," he said, "is that no one else was Edison." As to the range of his activities, he has been associated in some way with so many of the great modern developments that people sometimes speak as if he had invented *everything*, even electricity itself, or if they do not go to this length, they find it necessary to explain why he did not invent this or that. The fact that his name is not intimately associated with one of the great modern achievements—the development of the aeroplane—has called forth numerous ingenious explanations. One of these is that it is due to discouragement resulting from his experience as a boy with an experiment that has often been described. It is said that he induced another boy to swallow large quantities of Seidlitz powders and encouraged him to believe that sufficient gases would be generated to enable him to fly. Whether this be history or fable I know not, but, seeing that he has done so much, we need not spend much time in wondering why he has not done more. Nor need we attempt the impossible in the effort to measure the debt that mankind owes to him. Such statements as have been made to the effect that his inventions have given rise to industries that employ nearly a million of men and thousands of millions of capital really give no adequate sense of the value of his achievements, although they may be of some use as a very rough indication of the scale of his activities.

Not only has he shown his faith in science by great achievements, but he has proved himself a great force in education by giving so brilliant an exhibition of the *method* of science, the method of experimentation. When we get to the root of the matter we see that nearly all great advances are made by improvements in method. There is no evidence that men are abler in the twentieth century than they were in the Middle Ages, but they have learned a new method. "It was in Boston," said Edison, "that I bought Faraday's works, and appreciated that he was the master experimenter." It is interesting to think what Edison's appreciation of this fact has meant for the world. His popularity and the place that he holds in the public esteem have forced newspaper men to write so much about him that they have often had to rely upon imagination. It is not surprising, therefore, that there are many current myths regarding Mr. Edison. The popular desire for dramatic contrast suggests that to reach the heights of prosperity and public esteem that he has occupied for long, he must have risen from the depths of poverty and neglect. This is a pure myth, harmless, perhaps, and possibly useful as a spur to ambitious youth. A less innocuous myth is the one that sets him up as a "practical man" in the narrow sense. It is true that he has described himself as "pure practise" in distinction from Mr. Steinmetz whom he has called "pure theory," but this, of course, was a joke. Newspaper men have expanded it so as to make it appear that Edison knows nothing about science, cares nothing for the achievements of the great experimenters and thinkers who have preceded him, and merely tries everything that he can think of until he happens upon what he is seeking. Few things more absurd could be suggested. He is no slave to theory; he is ready, as every scientific man is ready, to try anything that seems reasonable, but practically always he has what seems to him a good reason for everything that he tries. In the rare cases where he has tried blindly, it has been because there was absolutely no light.

Just one more observation and I am done. His other great contribution to the progress of education has been his constant insistence on the gospel of work. Genius was long ago described as "an infinite capacity for taking pains." We all feel this to be inadequate, and Edison has put the underlying thought more accurately and more picturesquely by his aphorism that "genius is one per cent. inspiration and ninety-nine per cent. perspiration." Contrary to the general notion, very few of his inventions have been the result of sudden inspiration. Practically all have been evolved by slow and gradual processes. His day is

said to be a twenty-four-hour day, and he is always working when there is anything to do. Weeks and months and sometimes years of tedious experimenting, dauntless patience and unflagging industry, have marked his onward march to victory from the beginning until now. His is a splendid example of scientific pertinacity rarely if ever surpassed in the history of human achievement. He has won and held the admiration of the world; and his influence must remain as a permanent source of inspiration both within the schools and without.

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THE PROCEEDINGS OF THE NATIONAL ACADEMY AS A MEDIUM OF PUBLICATION

THE establishment of monthly *Proceedings* by the National Academy of Sciences, in which the first announcements of new advances are made, has met with instant recognition by a wide circle of investigators. Eighty-three original papers have appeared in the first five numbers, and the inflow of manuscripts is continually increasing. Many university departments and several research laboratories, namely, the Rockefeller Medical Institute, the Lick and Yerkes Observatories, the Nutrition, Experimental Evolution, and Marine Biological Laboratories and the Mount Wilson Observatory of the Carnegie Institution, and the Research Laboratories of Harvard University and the Massachusetts Institute of Technology have already indicated their intention of adopting the *Proceedings* as their regular medium for announcing new and important results. The success of the *Proceedings* is therefore amply assured.

The need of a national journal representing the joint interests of science as a whole and providing for the prompt publication and wide distribution of the chief results of American research has been felt in every department of science. The vigorous developments of science in recent years have carried us past the time when all of the special journals could assure early publication; and their very multiplicity has stood in the way of wide foreign circulation. Four leading American journals of biology have an average paid foreign circulation of 93 copies (maximum 109, minimum 77). This is not due to any inferiority in quality, as all of these journals are of the first rank. Nor does it indicate that they are undesirable places to publish. On the contrary, they have come into existence to meet a natural demand, and they certainly afford the most satisfactory means of publishing extended technical papers, intended for investigators in the fields which they represent. The *Proceedings* are expected to supplement them and should aid materially in increasing their circulation; for authors are requested to adopt the uniform practise of referring in each article to the journal in which the details of their investigations will subsequently appear. Such frequent references, seen by a wide circle of readers, will soon have their effect.

It is in the character and scope of their circulation that the *Proceedings* will perform their best service. Truly national in character, with a membership elected on equal terms from all sections of the country, and serving as the representative of the United States in the International Association of Academies, the National Academy of Sciences is peculiarly fitted to bring its publications to the attention of foreign readers. In Europe the academy is regarded as the natural representative of American research, and this fact gives at once to the *Proceedings* an authoritative standing among foreign investigators.

As foreign secretary of the academy, I have been called upon to prepare, with the cooperation of the editors representing all departments of science, a comprehensive list of foreign exchanges. Every effort has been made to secure a well-balanced distribution. From the extensive data in *Minerva* relating to academies, societies, universities, seminars, general and special libraries, laboratories, observatories, museums, botanical and zoological gardens, biological stations, geological surveys, and other centers of study and research, a representative group of about 900 foreign institutions has been compiled. In preparing this mailing list use has also been made of the ex-